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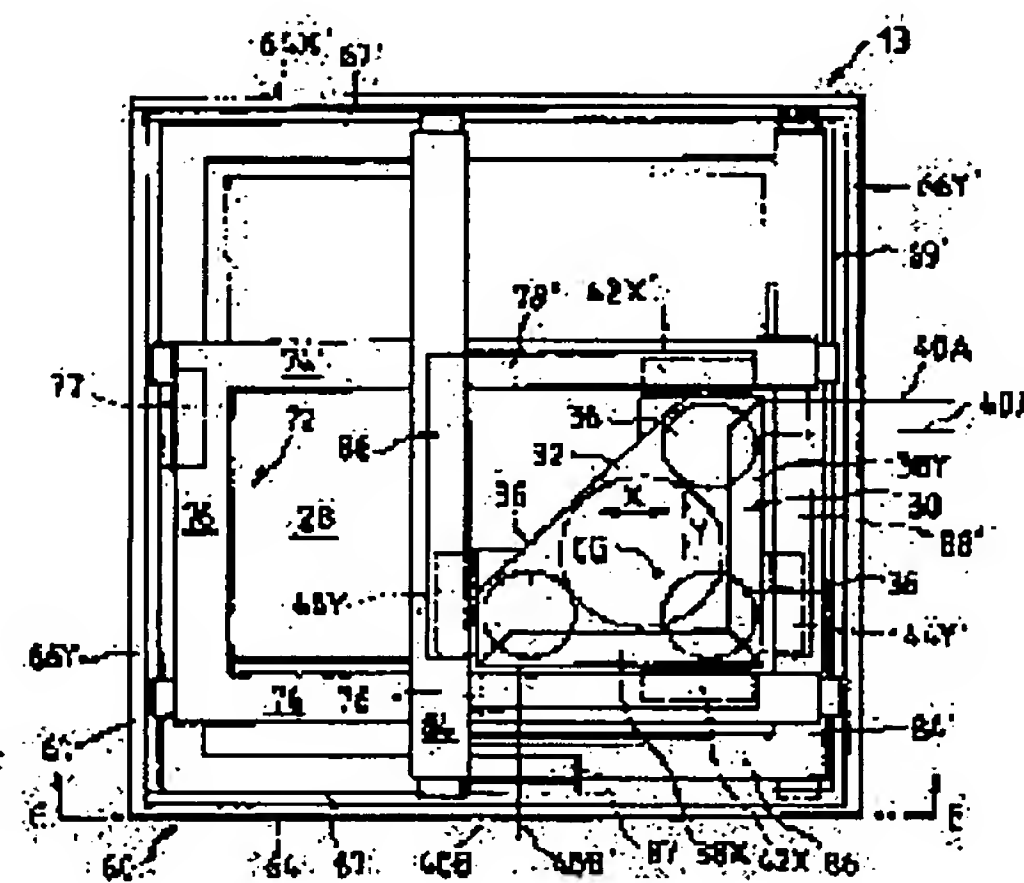
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## (54) POSITIONING DEVICE, ALIGNMENT DEVICE AND POSITIONING METHOD

(57)Abstract:

PURPOSE: To support an object and control the positioning so that the reaction force and the vibration caused by the motion of the object do not propagate to such an element as lens system.

CONSTITUTION: A reaction frame 61 insulating the external vibration and that caused by the reaction force from an object stage 30 is provided. The object stage 30 moves in two directions. The reaction frame is provided by two followers. Cooperating direct drive force actuators are provided on the object stage and the followers and the object stage is positioned in the first and the second directions. The reaction frame is fixed to a base structure and the object stage is supported in the space independently of the reaction frame. The follower 72 has a pair of arms 74, 74' and moves in a pair of parallel planes wherein the center of gravity of the object stage. The positioning force of actuator driving means is controlled so that the vector sum of the moments of forces at the gravity center of the object stage becomes practically zero.



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CLAIMS

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[Claim(s)]

[Claim 1] In the positioning device (a) which operates on base structure The reaction frame assembly containing the reaction frame attached in said base structure, (b) The object stage which exercises relatively to the base of an object stage, (c) The means for setting spacing from the base of said object stage, and supporting said object stage independently with said reaction frame, (d) It is attached in said object stage and said reaction frame assembly. Become a pair for positioning said object stage, collaborate, and it has the actuator means of the direct-acting mold which generates the force. The pointing device which the base of said object stage and said object stage are insulated from the reaction force from said actuator means, and is characterized by transfer of the vibration to the base of said object stage and said object stage serving as min by this.

[Claim 2] The positioning device with which said reaction frame assembly is characterized by having the follower who can exercise for said object stage independently and can follow it in the positioning device of claim 1.

[Claim 3] The positioning device characterized by equipping said actuator means with at least one linear motor which operates between said object stage and said reaction frame assembly in the positioning device of claim 1.

[Claim 4] the positioning device with which it has the actuator means of a lot at least in the positioning device of claim 1 in order to position said object stage, and the actuator means of these each is characterized by having the driving member attached in said object stage.

[Claim 5] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of said driving member is characterized by being substantially equal to zero in the positioning device of claim 4.

[Claim 6] The positioning device characterized by having at least one driving member attached in said object stage in the positioning device of claim 2.

[Claim 7] The pointing device characterized by for said follower having two arms which can exercise, respectively in two parallel flat surfaces, and the center of gravity of said object stage being between said two flat surfaces in the pointing device of claim 2.

[Claim 8] In the positioning device of claim 1 said object stage In the 1st direction, and this 1st direction and the 2nd direction which makes an include angle, it can exercise at least. The 1st follower is movable only in said 1st direction, and follows said object stage. The 2nd follower is movable only in said 2nd direction, and follows said object stage. Moreover, said actuator means to collaborate The pointing device characterized by being prepared for said object stage and said 1st and 2nd followers, and positioning said object stage in said 1st and 2nd directions.

[Claim 9] It is the positioning device characterized by having the direct-acting mold actuator which generates at least three force in which said actuator means operates between said object stage and said reaction frame assembly in the positioning device of claim 8.

[Claim 10] The positioning device with which it is prepared and the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to zero in the positioning device of claim 9 as said object stage driven in said 1st direction in two of said at least three direct-acting mold actuators.

[Claim 11] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage where one of said the direct-acting mold actuators other than said two direct-acting mold actuators is attached in said object stage, and it originates in the positioning force of said actuator means to collaborate, in the positioning device of claim 10 so that said object stage may be driven in said 2nd

direction is characterized by being substantially equal to zero.

[Claim 12] In the positioning device of claim 8, it has at least 2 sets of direct-acting mold actuators for positioning said object stage. 1 set in these direct-acting mold actuator 1 set which will position said object stage in said 1st direction, and will accept it among said direct-acting mold actuators The pointing device with which the vector sum of the moment of force in the center of gravity of an X-Y stage which positions said object stage in said 2nd direction, and originates in the location force of an actuator means to these-collaborate is characterized by being substantially equal to zero.

[Claim 13] It is the pointing device which said 1st and 2nd followers have two arms \*\*\*\*(ed) respectively in the pointing device of claim 8, one follower's arm is located in a single flat surface, and can exercise, and is characterized by locating the arm of the follower of another side in two parallel flat surfaces in which said single flat surface is located between them, and being able to exercise.

[Claim 14] The positioning device with which the center of gravity of said object stage is characterized by being adjacently located in the inside of said single flat surface, or the flat surface of this single in the positioning device of claim 13.

[Claim 15] In a pointing device (a) In the 2nd direction which makes an include angle in the 1st direction and this 1st direction Object stage which exercises at least (b) With the 1st follower who is movable only in said 1st direction and follows said object stage (c) With the 2nd follower who is movable only in said 2nd direction and follows said object stage (d) Pointing device characterized by having a force actuator means of a direct-acting mold to collaborate for being attached in said object stage and a list at said 1st and 2nd followers, and positioning said object stage in said 1st and 2nd directions.

[Claim 16] It is the positioning device characterized by having at least three direct-acting type force actuators with which said actuator means operates among said object stage and said each follower in the positioning device of claim 15.

[Claim 17] The positioning device with which it is prepared and the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to zero in the positioning device of claim 16 as said object stage driven in said 1st direction in two of said at least three direct-acting mold actuators.

[Claim 18] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage where one of said the direct-acting mold actuators other than said two direct-acting mold actuators is attached in said object stage, and it originates in the positioning force of said actuator means to collaborate, in the positioning device of claim 17 so that said object stage may be driven in said 2nd direction is characterized by being substantially equal to zero.

[Claim 19] In the positioning device of claim 15, it has at least 2 sets of direct-acting mold actuators for positioning said object stage. 1 set in these direct-acting mold actuator Said object stage is positioned in said 1st direction. Another side of said direct-acting mold actuators The pointing device with which the vector sum of the moment of force in the center of gravity of an object stage which positions said object stage in said 2nd direction, and originates in the location force of an actuator means to these-collaborate is characterized by being substantially equal to zero.

[Claim 20] It is the pointing device which said 1st and 2nd followers have two arms \*\*\*\*(ed) respectively in the pointing device of claim 15, one follower's arm is located in a single flat surface, and can exercise, and is characterized by locating the arm of the follower of another side in two parallel flat surfaces in which said single flat surface is located between them, and being able to exercise.

[Claim 21] It is the pointing device with which the vector sum of the moment of force in the center of gravity of said object stage which originates in the positioning force of a driving member of said follower having at least one driving member in each, and collaborating, in the pointing device of claim 20 is characterized by being substantially equal to zero.

[Claim 22] The positioning device with which the center of gravity of said object stage is characterized by being adjacently located in the inside of said single flat surface, or the flat surface of this single in the positioning device of claim 20.

[Claim 23] The reaction frame assembly which has the reaction frame prepared in the base and base structure of an object stage in the positioning device of claim 15, The means for supporting said each follower from said reaction frame assembly, With said reaction frame, the base of said object stage to spacing is set for said object stage, and it has a means for supporting independently. By this The pointing device characterized by being constituted so that the base of said object stage and said object stage may be insulated from vibration produced according to each reaction force, therefore vibration of the base of said object stage and said object stage may become min.

[Claim 24] In alignment equipment (a) The X-Y stage which has a center of gravity, (b) The means for setting said X-Y stage from the base of an X-Y stage, and supporting spacing, (c) It has the reaction frame assembly which has the reaction frame which became independent of the base of said X-Y stage, and which was supported on the base of a reaction frame. (d) Said reaction frame assembly And it has independently Y follower who can exercise. becoming independent -- X follower who can exercise -- an installation \*\*\*\*\* X follower possible [ movement ] on said reaction frame an installation \*\*\*\*\* Y follower possible [ movement on said reaction frame ] that it can exercise in the direction of X It can exercise in the direction of Y (e). Either said X follower or Y follower It has at least two \*\*\*\*(ed) arms. Another side of said X follower and Y follower It has at least one arm. The alignment equipment concerned further (f) It is prepared by the relation \*\*\*\*(ed) among said X-Y stage and said each follower. It has a direct-acting mold actuator means for the pair for positioning said X-Y stage horizontally to collaborate, and to generate the force (g). Said actuator means It is prepared in said X-Y stage to the drive partial element means formed in the arm of said follower of each, and it. It has a drive primary-member means to collaborate with said drive partial element means, and to position said X-Y stage. The base of said X-Y stage and said X-Y stage Alignment equipment which is insulated from vibration produced according to reaction force, and is characterized by being constituted so that the base of said X-Y stage and vibration of said X-Y stage may become min by this.

[Claim 25] In the alignment equipment of claim 24, said one arm prepared for either said X follower or the Y followers Two arms which are arms of said pair which could exercise in the single flat surface and was prepared in another side of said X follower and Y follower Alignment equipment characterized by locating in two independent flat surfaces in which said single flat surface is located between them, respectively, and being able to exercise in this flat surface.

[Claim 26] Alignment equipment with which the vector sum of the moment of force in the center of gravity of said X-Y stage which has said drive partial element means formed in the arm of said pair of said one follower in the alignment equipment of claim 25, is equipped with the means for controlling it, and originates in the positioning force of a drive primary-member means to collaborate is characterized by being substantially equal to zero.

[Claim 27] In the approach (a) for positioning an object The process which positions a reaction frame on the base, (b) Process which supports an object on an object stage (c) About said object, said reaction frame becomes independent. The process which supports said object stage on space in a certain location from the base of an object stage, (d) Apply the force between said object stages and said reaction frames, and said object stage is driven in the new location of at least one direction of [ on space ]. The positioning approach characterized by having the process which insulates the base of said object stage from the reaction force produced by applying said force to coincidence.

[Claim 28] By the 1st follower and 2nd follower, by moving in the 1st direction and 2nd direction at least In the approach (a) of positioning an object stage to space The process which supports said object stage to space, (b) The force among said object stage and said 1st follower In addition, the process which drives said object stage only in said 1st direction, (c) The force among said object stage and said 2nd follower In addition, the process which drives said object stage only in said 2nd direction, (d) Only in said 2nd direction, it becomes independent of said 2nd follower. The process which drives said 1st follower and is made to follow said object stage, (e) The positioning approach of the object characterized by driving said 2nd follower and having independently the process made to follow said object stage with said first follower only in said 1st direction.

[Claim 29] The positioning device with which it has a means to attach said actuator means between said object stages and said reaction frames, in the positioning device of claim 1, and this installation is characterized by the strong thing in the direction of driving force at least.

[Claim 30] The positioning device with which it has a means to attach said actuator means among said object stage and said each follower, in the positioning device of claim 15, and this installation is characterized by the strong thing in said direction of driving force at least.

[Claim 31] The positioning device with which it has in the positioning device of claim 24 with a means to attach said actuator means among said X-Y stage and said each follower, and this installation is characterized by the strong thing in said direction of driving force at least.

[Claim 32] In the precision pointing device made as [ collaborate / although it has the stage which can exercise along a predetermined direction in a flat surface top ] the base plate which has a flat surface -- this - (a) The 1st support assembly for supporting said base plate on a foundation, (b) It has an actuator assembly for giving electromagnetic force to the stage in which said movement is possible along said predetermined

direction. This actuator assembly is (i). The passive-movement section which is attached in the stage in which said movement is possible, and can exercise in said predetermined direction and which can be exercised, And (ii) The mechanical component located in the perimeter of the stage in which said movement is possible is provided. (iii) Either said passive-movement section or said mechanical component has a coil unit. Moreover, another side of said passive-movement section and said mechanical component has the magnetic unit, and is (c) further. Said mechanical component is supported independently on said foundation with said 1st support assembly. By this The precision pointing device characterized by having the 2nd support assembly which forms a predetermined gap between said coil units and said magnetic units. [Claim 33] The precision positioning device characterized by holding said mechanical component of said actuator assembly to said predetermined direction in the precision positioning device of claim 32 in the stationary location.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] Generally especially this invention relates a wafer to the approach and equipment support and for carrying out alignment and insulating the equipment from the reaction force and extraneous vibration of itself in microscope RORISO graph equipment about electromechanical collimation adjustment, i.e., alignment, and vibration isolation.

[0002]

[Description of the Prior Art] The various support devices used for a microscope RORISO graph device and a positioning device are known. In the conventional technique, generally, XY guide equipped with separate X guide assembly and Y guide assembly is used, and one guide assembly is attached possible [ movement ] on the guide assembly of another side. A separate wafer stage is established in the crowning of the above-mentioned guide assembly in many cases. Such structure needs the components of a high precision and many. Generally, the external force which joins the components of a positioning assembly, and the reaction force resulting from movement of the components of others of the above-mentioned positioning assembly are directly transmitted to the device which processes image formation optical system and a reticle (reticle), and, as a result, produce vibration which is not desirable.

[0003] United States patent 5th and No. 120 or 03 (Van Engelen et al.) are indicating the pointing device of the two-step type for optical RISOGURAFU equipments, and the Lorentz force and static pressure gas bearing are used for this pointing device.

[0004] U.S. Pat. No. 4,952,858 -- electromagnetism -- the thing about the micro lithograph equipment using alignment equipment -- it is -- the above -- electromagnetism -- alignment equipment is equipped with a monolithic stage, a substage, and the criteria structure by which vibration isolation was carried out, and has supported and positioned the above-mentioned monolithic stage on space using the force actuator formed between the above-mentioned monolithic stage and a substage. In this equipment, Y frames, i.e., Y stage, are attached in an X frame, and from Y frames, the above-mentioned monolithic stage places space and is supported [ above-mentioned ].

[0005]

[Problem(s) to be Solved by the Invention] The overall purpose of this invention is offering the approach and equipment using the guide loess stage for supporting the above-mentioned object while being equipped with the reaction frame insulated from other elements like the lens system which generates the image exposed in both reaction force by the external force list produced in case an object exercises at the photoresist on the object front face of a wafer.

[0006]

[Means for Solving the Problem] The equipment of this invention is formed at a means, and an object stage and a reaction frame for the above-mentioned reaction frame to support independently to space an object stage, the reaction frame which vibration is not substantially delivered between itself and an object stage while being attached in the base, and the above-mentioned object, becomes a pair for positioning an object stage, collaborates, and is equipped with a direct-acting mold actuator means generate the force. An object stage is in the condition supported by space in the Z direction, and can constitute the X-Y stage which can prepare so that it may exercise in the predetermined direction, or exercises in the direction of X, and the direction of Y.

[0007] The effective description of this invention is offering support, positioning, and the assembly that carries out vibration isolation, this assembly enables the positioning function to in\_ which the stage of an object or a wafer should be performed, vibration transmitted to the above-mentioned stage and a lens system

lessens quick extremely with few components from the stage which received reaction on that occasion, and while minimizing vibration transmitted to coincidence on the above-mentioned stage, the above-mentioned stage insulates from the reaction force which is not desirable.

[0008] According to another description of this invention, the positioning approach for X-Y stages and a positioning device are offered, and the above-mentioned X-Y stage is equipped with the force actuator of X follower who can exercise, and the direct-acting mold which is formed between the above-mentioned X-Y stage and each follower at Y follower who can exercise, and a list, and collaborates, and, thereby, is made independently as [ interfere / in movement of the follower of another side / movement of which follower ].

[0009] According to another description of this invention, the arm of a pair is prepared for at least one follower, and as for each arm, it has a driving member, and the above-mentioned arm is located in the upper part of a center of gravity and the flat surface \*\*\*\*(ed) caudad of an object stage, and can exercise in this flat surface.

[0010] According to another description of this invention, the above-mentioned guide loess stage is equipped with the force actuator of at least three direct-acting molds, two of these actuators are driven in either the direction of X, or the direction of Y, and the 3rd actuator is driven on another side of the direction of X, and the direction of Y. According to the desirable example of this invention, a guide loess stage is equipped with at least four direct-acting mold actuators between an X-Y stage and a reaction frame assembly, each actuator has the driving member prepared in an X-Y stage, and this plays the role to which X driving member of a pair drives and controls an X-Y stage automatically in the direction of X, and the role to which Y driving member of a pair drives and controls an X-Y stage automatically in the direction of Y is played. It is constituted, and it is positioned and direct-acting mold actuators and these driving members are controlled so that the vector sum of the moment of force in the center of gravity of an X-Y stage resulting from the location force of a driving member of collaborating becomes equal to zero substantially.

[0011] The description and effectiveness of this invention will become clearer when the same reference mark reads the following explanation through the whole with reference to the drawing in which the same part is shown.

[0012]

[Example] it has a vibration-isolation reaction frame -- it is -- it is -- although having many applications over the device of the type with which it differs for the guide loess stage which it does not have to position [ many of ] an object correctly will be understood by this contractor, this invention explains about the desirable example of the gestalt of the microphone RORISO graph equipment for carrying out alignment of the wafer in the equipment with which a lens forms the image expose by the photoresist on the front face of a wafer. moreover, it has a vibration isolation stage -- it is -- it is -- although the guide loess stage which it does not have can be used as a guide loess object stage which can exercise only for the one direction of for example, the direction of X, or the direction of Y, the desirable example of this invention is explained about XY wafer stage of the guide loess explained below.

[0013] Reference of a drawing especially drawing 1 thru/or drawing 5 shows HOTORISO graph equipment 10 equipped with upper optical equipment 12 and the downward wafer support pointing device 13. Optical equipment 12 is equipped with the illuminator 14 equipped with the ellipsoid mirror EM which surrounds the lamp LMP like a mercury lamp, and this lamp LMP. The illuminator 14 is equipped with the optical integrator for generating the secondary light source image like the eye type lens FEL of a fly, and condenser lens CL for irradiating Reticle (mask) R by the equalized flux of light. The mask holder RST holding Mask R is attached above the lens-barrel PL of projection optics equipment 16. Lens-barrel PL is being fixed to a part of column assembly currently supported on the high arm 18 of two or more rigidity respectively attached in the crowning of the insulating pad 20, i.e., a blocking device.

[0014] The inertia block 22, i.e., an oscillating absorption block, is formed in equipment so that it may cling to an arm 18. In order to avoid conveying the structure with weight, after conveying the above-mentioned block 22 by the state of the sky, it can take the gestalt of the cast box which can fill up sand with an actuation site. The base 28 of an object stage, i.e., a wafer stage, is supported from the arm 18 with the hanging block 22, the hanging bar 26, and the level bar 27 (refer to drawing 2 ).

[0015] If drawing 5 thru/or drawing 7 are referred to, the top view and elevation of a wafer support pointing device on the base 28 of an object stage, i.e., a wafer stage, are shown, respectively, and the above-mentioned wafer support pointing device is equipped with object (wafer) X-Y stage 30 and the reaction frame assembly 60. X-Y stage 30 is equipped with the support plate 32, and the wafer 34 like a 12 inch (304.8mm) wafer is supported on this support plate. The plate 32 is supported by the pneumatic bearing 36 of a vacuum precompression mold controllable to adjust an inclination, a sideslip, and a focus in the upper

space of the base 28 of an object stage so that Z may be adjusted. Or in order to perform, this support, i.e., support, the combination of a magnet and a coil is also employable.

[0016] X-Y stage 30 is equipped also with the proper element which consists of the magnetic coupling means like the drive motor of a direct-acting mold again, and this element carries out alignment of the wafer to the lens of optical equipment 16, and it positions correctly the image for exposing the photoresist of the front face of a wafer. illustration -- an example -- setting -- being magnetic -- a coupling means -- an X-Y stage -- 30 -- X -- a direction -- setting -- positioning -- a sake -- X -- a drive coil -- 42 -- X -- 42 -- X -- ' -- like -- a pair -- X -- a driving member -- an X-Y stage -- 30 -- Y -- a direction -- setting -- positioning -- a sake -- a drive coil -- 44 -- Y -- 44 -- Y -- ' -- like -- a pair -- Y -- a driving member -- from -- changing -- a gestalt -- taking . The part to which the magnetic coupling means on the reaction frame assembly 60 relates is later explained to a detail.

[0017] X-Y stage 30 is equipped with the laser mirrors 38X and 38Y of a pair. The above-mentioned laser mirror 38X It operates to laser beam 40A/40A' of the pair of laser beam interferometer equipment 92. Moreover, the above-mentioned laser mirror 38Y It operates to laser beam 40B/40B' of the pair of the above-mentioned interferometer equipment, and exact XY location of the above-mentioned X-Y stage is determined and controlled to the fixed mirror RMX in the lower part section of the lens-barrel PL of projection optics equipment 16.

[0018] If drawing 8 and drawing 9 are referred to, the reaction frame assembly 60 is equipped with the reaction frame 61 which has two or more support posts 62, and the above-mentioned support post is attached in the ground or the separate base so that vibration may not be substantially transmitted between this support post and an object stage.

[0019] reaction -- a frame -- 61 -- a support -- a post -- 62 -- between -- X -- a direction -- elongating -- a field -- a plate -- 64 -- X -- 64 -- X -- ' -- a support -- a post -- between -- Y -- a direction -- elongating -- a field -- a plate -- 66 -- Y -- 66 -- Y -- ' -- having -- \*\*\*\* . a field -- a plate -- 64 - 66 -- the inside -- \*\*\*\* -- plurality -- reaction -- a frame -- a rail -- 67 - 69 -- and -- 67 -- ' - 69 -- ' -- preparing -- having -- X -- a follower -- 72 -- and -- Y -- a follower -- 82 -- supporting -- showing around -- \*\*\*\* . Inside field plate 64X, the upper follower guide rail 67 and the downward follower guide rail 68 (not shown) are formed, and follower guide-rail 67' of the upper part and a lower part and 68' are prepared in the medial surface of field plate 64X' of the opposite side. The single guide rail 69 perpendicularly arranged among guide rails 67 and 68 and 69' are prepared in the medial surface of each field plate 66Y and 66Y', respectively.

[0020] X follower has the arm 74 of the \*\*\*\*(ed) pair, and 74', and the end section of these arms is being fixed to the crosspiece 76. The drive truck 78 and the drive element like 78' (refer to drawing 5 ) are prepared in an arm 74 and 74', respectively, and are made as [ collaborate / with drive element 42X of an X-Y stage, and 42X' ]. In the example of illustration, since drive element 42X on an X-Y stage and 42X' are shown as a drive coil, the drive truck on the X follower 72 has taken the magnetic gestalt. Moreover, a joint element can be reversed, a coil can be prepared on X follower, and a magnet can also be formed on an X-Y stage. In case an X-Y stage drives in X and the direction of Y, laser interferometer equipment 92 detects the new location of an X-Y stage in an instant, and generates positional information (value of X coordinate). X-Y stage 30 is followed without the positional controller 94 of the servo mold controlled by the host processor (CPU) 96 controlling the location of the X follower 72 and the Y follower 82, and carrying out mechanical association of between drive coil 42X and 42X', and trucks 74 and 74' according to the positional information from interferometer equipment 92, so that it may explain to a detail later with reference to drawing 10 .

[0021] X -- a follower -- 72 -- reaction -- a frame -- 61 -- movement -- possible -- attaching -- a sake -- reaction -- a frame -- 61 -- a side -- it is -- an arm -- 74 -- 74 -- ' -- an edge -- a rail -- 69 -- a top -- riding -- showing around -- having -- an arm -- 74 -- 74 -- ' -- the opposite side -- an edge -- a field -- a plate -- 66 -- Y -- ' -- adjoining -- a rail -- 69 -- ' -- riding -- \*\*\*\* . In order to move the X follower 72, a driving member 77 is formed on a crosspiece 76, collaborates with the reaction frame guide 69, and moves a follower 72 in the direction which intersects perpendicularly to the direction of X of an X-Y stage. Since exact control and an exact drive are performed by X-Y stage 30, the X follower's 72 point to point control does not need to prepare strict tolerance and a strict air gap in about 30 X-Y stage like an X-Y stage correctly. therefore, a drive 77 can be made into the combination of the combination of the screw shaft which rotates by the motor, and the nut which engages with the X follower 72 or the coil assembly which forms a linear motor, and a magnet assembly, and can combine the combination of each above with a roller guide device further.

[0022] X -- a follower -- 72 -- the same -- Y -- a follower -- 82 -- the -- an end -- the section -- a crosspiece - - 86 -- fixing -- having had -- a pair -- an arm -- 84 -- 84 -- ' -- having -- \*\*\*\* -- these -- an arm -- Y -- a

driving member -- 44 -- Y -- 44 -- Y -- ' -- collaborating -- a truck -- 88 -- 88 -- ' -- having -- \*\*\*\* . The Y follower's 82 arm 84 and 84' are guided on a separate guide rail. On the upper rail 67 and 67', the both ends of an arm 84 ride, and are shown, and the both ends of arm 84' are shown on the downward rail 68 and 68'. A drive 87 is formed in the Y follower's 82 crosspiece 86, and moves the Y follower 82 in the direction which intersects perpendicularly in the direction of Y of an X-Y stage along with guide 67, 67' and 68, and 68' between field plate 66Y and 66Y'.

[0023] All of the X follower's 72 arm 74, 74', and crosspiece 76' are arranged in the same flat surface which intersects perpendicularly with Z axis, and they move so that it may be best shown in drawing 9 . The center of gravity of X-Y stage 30 is in the above-mentioned flat surface, or adjoins this flat surface immediately. In this structure, each drive coil 42X and the driving force from 42X' work in an arm 74 and the direction which meets the die length of 74', respectively. However, the Y follower's 82 arm 84 and 84' are mutually \*\*\*\*(ed) along with Z axis, and each is the upper part of a flat surface including the X follower 72, and in a separate parallel flat surface parallel [ that it is caudad ] to this flat surface, and moves in that flat surface. In a desirable example, a crosspiece 86 is in the flat surface of the lower part containing arm 84', and spacer block 86' is located between the edges where an arm 84 and crosspieces 86 overlap, and it is \*\*\*\*(ing) an arm 84 and 84' at each parallel flat surface. Each drive coil 44Y and the driving force from 44Y' work like the X follower 72 in an arm 84 and the direction which meets the die length of 84'. Moreover, between drive coil 44Y (44Y') and the drive truck 88 (88'), the predetermined gap was maintained by the direction of X, and the Z direction, and the concept of guide loess is attained.

[0024] In case the guide loess stage of this invention and the reaction frame of a vibration isolation mold operate X-Y stage 30 is positioned by the initial valve position to a projection lens detected by interferometer equipment 92. X-Y stage 30 a drive -- a truck -- 78 -- 78 -- ' -- 88 -- 88 -- ' -- a configuration - - depending -- a drive -- an element -- from -- a drive coil -- 42 -- X -- 42 -- X -- ' -- 44 -- Y -- 44 -- Y -- ' -- \*\*\*\*(ing) -- having had -- a condition -- pneumatic bearing -- an object -- a stage -- the base -- 28 -- from -- a Z direction -- supporting -- having . There is no contact between X-Y stage 30 and the reaction frame 61. That is, vibration of a reaction frame is transmitted and the path which affects the location of an X-Y stage, or its opposite path does not exist at all. The indirect contact which minds [ the means of communication which sends a signal to a coil, and ] the location detection equipment of a laser interferometer only exists, and other commands which start the driving signal with which delivery and this control device produce movement of X-Y stage 30 for the positional information which detected the above-mentioned location detection equipment to a controller, i.e., a control device, are received.

[0025] an interferometer -- equipment -- 92 -- from -- an X-Y stage -- a location -- understanding -- if -- a driving signal -- a positional controller -- 94 -- from -- being suitable -- a drive coil -- 42 -- X -- 42 -- X -- ' -- 44 -- Y -- 44 -- Y -- ' -- sending -- having -- an X-Y stage -- the location of a new request -- driving . Movement of an X-Y stage is detected by interferometer equipment 92 and position sensors 98X and 98Y (refer to drawing 10 ), and the X follower 72 and the Y follower 82 drive by driving members 77 and 87, respectively, and follow an X-Y stage. As shown in drawing 10 , position-sensor 98X detects fluctuation of spacing of the direction of Y between X-Y stage 30 and the X follower 72, and sends the electrical signal showing the value of the spacing to a positional controller 94. A positional controller 94 generates the proper driving signal about a driving member 77 in X location from interferometer equipment 92, and a list based on the signal from position-sensor 98X.

[0026] Moreover, position-sensor 98Y detects fluctuation of spacing of the direction of X between X-Y stage 30 and the Y follower 82, and generates the electrical signal showing the value of the spacing, and a driving member 87 drives it in the information on Y location from interferometer equipment 92, and a list based on the signal from position-sensor 98Y.

[0027] Yaw angle correction is performed by the motor pair which can be used in order to maintain or amend a yaw include angle. That is, the above-mentioned motor pair can change the location of the hand of cut of an X-Y stage. The data from both laser beam 40A/40A', and 40B/40B' are used in order to acquire yaw include-angle information. [ both / one side or ] Electronic subtraction of the digital location data obtained from the measurement using laser beam 40A, 40A' or 40B, and 40B' is performed, or both difference is added, and it divides by 2.

[0028] This invention makes it possible to perform the positioning function of an X-Y stage more quickly than the case where XY guide is used. The reaction force produced in case an X-Y stage moves is separated from image formation optical system and a reticle processor device.

[0029] Since this invention does not need exact X guide or Y guide at all and does not have a precise guide as compared with the stage guided, actuation of the precise assembly of the X-Y stage of a wafer and

accommodation decreases. Since the force of the linear motor in XY axis carries out a direct action to the stage of a wafer, that is, the above-mentioned linear motor does not need to act through guide equipment, the control bandwidth of a servo increases.

[0030] Altogether, the force from XY linear motor can be made to transmit through the center of gravity of an X-Y stage substantially, and, thereby, eliminates the moment of force (torque) which is not desirable.

[0031] the X follower 72 and the Y follower 82 who it has each other independently completely, and operate -- using -- as magnetic coupling between each followers 72 and 82 and X-Y stages 30 -- commercial -- available electromagnetism -- if a linear motor is used and the gap between a coil and a magnet drive truck is made smaller than about 1mm, any vibration of a follower will not be transmitted to the X-Y stage or optical equipment of a wafer. Moreover, the vector sum of the upper part of the arm of the follower of another side and the moment of force in the center of gravity of an X-Y stage if it \*\*\*\* caudad becomes equal to zero substantially according to the positioning force of a driving member of collaborating, about one follower's arm.

[0032] Between an X-Y stage and each follower stage, it could be considered that the connection to permit does not exist at all that vibration is transmitted in the degree of freedom of X, Y, or theta among these stages. Thereby, a follower stage can be attached in the vibrating criteria frame, without affecting the engine performance of the stage of a wafer. For example, an X-Y stage and projection optics equipment will not be influenced when a reaction frame hits with an obstruction.

[0033] When a center of gravity is between one of two X drive coils, and one of two Y drive coils and there is in the equal distance, thereby, driving an X-Y stage to a desired location will be understood by this contractor by sending the proper signal with which magnitude differs to each coil, and giving the bigger force to it at a heavier stage side. [ no ]

[0034] specification -- an application -- receiving -- electromagnetic force -- movement -- being possible -- an X-Y stage -- giving -- a sake -- an actuator -- namely, -- magnetic coupling -- an assembly -- a drive -- an element -- 42 -- X -- /-- 42 -- X -- ' -- or -- 42 -- Y -- /-- 42 -- Y -- ' -- X -- a direction -- or -- Y -- a direction -- it can set -- a stage -- movement -- being related -- respectively -- having stood it still -- a condition -- a fixed location -- it can hold (refer to drawing 10) .

[0035] As explanation of the last of this example, the essential structure of this invention is explained again with reference to drawing 4 . As shown in drawing 4 , X-Y stage 30 can exercise in X, Y, and the direction of theta on the stage base 28, without being supported with the flatness of the stage base 28 by the pneumatic bearing 36 which has an air discharge port and a vacuum precompression port on the smooth front face (it being parallel to a X-Y flat surface), and receiving friction in any way by it.

[0036] The stage base 28 is supported on the foundation (or the ground or base structure) with the vibration isolation block 20, the arm 18, the block 22, the perpendicular bar 26, and the level bar 27. Each vibration isolation block 20 is equipped with the oscillating absorption assembly which prevents transfer of the vibration from a foundation 21.

[0037] Since drawing 4 is a sectional view of X-Y stage 30 which meets the line which passes along drive coil 42X and 42X' in the direction of Y, the following explanation is limited to the X follower 72. drawing 4 -- setting -- a drive coil -- 42 -- X -- a follower -- an arm -- 74 -- equipping -- having had -- a drive -- a truck (train of a magnet long and slender in the direction of X) -- 78 -- a magnetic field -- inside -- preparing -- having -- \*\*\*\* -- a drive coil -- 42 -- X -- ' -- a follower -- an arm -- 74 -- ' -- equipping -- having had -- a drive -- a truck -- 78 -- ' -- a magnetic field -- inside -- preparing -- having -- \*\*\*\* .

[0038] Two arms 74 and 74' are strongly assembled by the guide rail 69 and 69' which were formed inside the reaction frame 61 so that it may move in the direction of Y together. Moreover, a guide rail 69 and 69' restrict X of two arms 74 and 74', and movement of a Z direction. The reaction frame 61 is directly supported independently on the foundation 21 in the stage base 28 in four support posts 62.

[0039] Therefore, drive coil 42X (42X') and the drive truck 78 (78') are arranged by each so that a predetermined gap (several mm) may be maintained in Y and a Z direction. Therefore, if drive coil 42X and 42X' drives and X-Y stage 30 is moved in the direction of X, the drive truck 78 and the reaction force produced in 78' will be transmitted to a foundation 21, and will not be transmitted to X-Y stage 30.

[0040] On the other hand, when X-Y stage 30 moves in the direction of Y, two arms 74 and 74' follow each drive truck 78 and 78' by this by moving in the direction of Y by the driving member 77 at each coil 42X and 42X' based on the measurement signal of position-sensor 98X, and the gap of the direction of Y is maintained.

[0041] Although this invention was explained to the list with reference to the driving member of a pair, i.e., coil 42X, 42X', and a desirable example equipped with driving member of pair, i.e., coil 44Y, and 44Y', it

can constitute a vibration isolation reaction frame and a guide loess stage according to \*\*\*\* shown in drawing 11 and drawing 12 , and this invention which has three driving members, i.e., a linear motor, exactly. As shown in drawing 11 , Y drive coil 144Y of a pair and 144Y' are prepared in a stage 130, and it is prepared according to center-of-gravity CG' of an X-Y stage, single X drive coil, i.e., linear motor 142X. Y drive coil 144Y and 144Y' is prepared in the Y follower's 182 arm 184, and 184', and X drive coil 144X is prepared in the X follower's 172 arm 174." An X-Y stage can be moved to desired XY location by giving a proper driving signal to drive coils 142X and 144Y and 144Y'.

[0042] next -- drawing 13 -- or -- drawing 16 -- referring to -- if -- this invention -- being another -- an example -- being shown -- having -- \*\*\*\* -- this -- an example -- XY -- a drive coil -- 242 -- X -- 242 -- X -- ' -- 244 -- Y -- 244 -- Y -- ' -- an X-Y stage -- 30 -- ' -- attachment -- the section -- between -- a link -- having -- \*\*\*\* . These bond parts are equipped with the double flat spring assembly 300 which combines drive coil 244Y with the end section of the bond part material 320, and the double flat spring assembly 320 which combines the other end of the bond part material 320 with X-Y stage 30'. The double flat spring assembly 300 has the flange 302 fixed to coil 244Y. Through the clamp bolt, the clamp member 304 is attached in the flange 302, and has faced across one edge of the level flexible link 306 between them. These level members are fixed to a perpendicular flange 310 and perpendicular one in order by pinching the other end of the flexible link 306 between two level members 308, the bolt stop of the flange material 312 of a pair is carried out to this perpendicular flange, and the flange material of this pair has faced across one edge of the perpendicular flexible member 314. It faces across the edge of perpendicular another side of the flexible member 314 between the flange material 316 of a pair, and the bolt stop of the flange material of this pair is carried out to the flange plate 318 of the end section of a holddown member 320 at order. In the other end of a holddown member 320, the plate 348 is being fixed to two flange material 36, and the bolt stop of these two flange material is mutually carried out so that the end section of the perpendicular flexible member 344 may be inserted. the flange material 342 faces across the edge of the perpendicular opposite side of a member 344, and these flange material is fixed to the plate 340 fixed to the clamp plate 338 of the pair which faces across one edge of the level flexible member 336 in order -- having -- \*\*\*\* -- the above -- the edge of the level opposite side of a flexible member is inserted into X-Y stage 30' in response to the assistance of a plate 334. Therefore, in each double flat spring assemblies 300 and 330, vibration decreases by [ level ] reaching and preparing both perpendicular flexible members. in the assembly of these each, a perpendicular flexible member decreases vibration of X, Y, and theta, and a level flexible member decreases vibration of Z, an inclination, and the sideslip direction. Therefore, eight horizontal deflection joint about Z, an inclination, and the sideslip direction is formed in the deflection joint of eight perpendicular directions about X, Y, and theta, and a list.

[0043] As shown in drawing 16 , coil 244Y is attached in coil support 245Y, this coil support has the upper support plate 246 attached in this, and this upper support plate has ridden on the crowning of the magnetic-track assembly 288. The pneumatic bearing 290 of a vacuum precompression mold is formed between the magnetic-track assemblies 288 as another side with coil support 245Y and the upper support plate 246 as one side again. In the example of actuation of the example shown in drawing 13 thru/or drawing 16 , for width of face, about 31.8 mm (1 1 / 4 inches) and die length are [ about 6.4mm (1/4 inch) and thickness ] 0.305mm (0.012 inches) stainless steel, and the direction of a primary deflection of the flexible members 306, 314, 344, and 336 is the direction of thickness. In the example of illustration, members 306 and 314 are in a direct crossover \*\*\*\* condition mutually about each direction of a primary deflection, and are arranged by the serial, and members 344 and 336 are arranged similarly.

[0044] Although this invention was explained about the desirable example, this invention can take the gestalt from which many differ, and the range of this invention is limited by only the claim.

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[Translation done.]

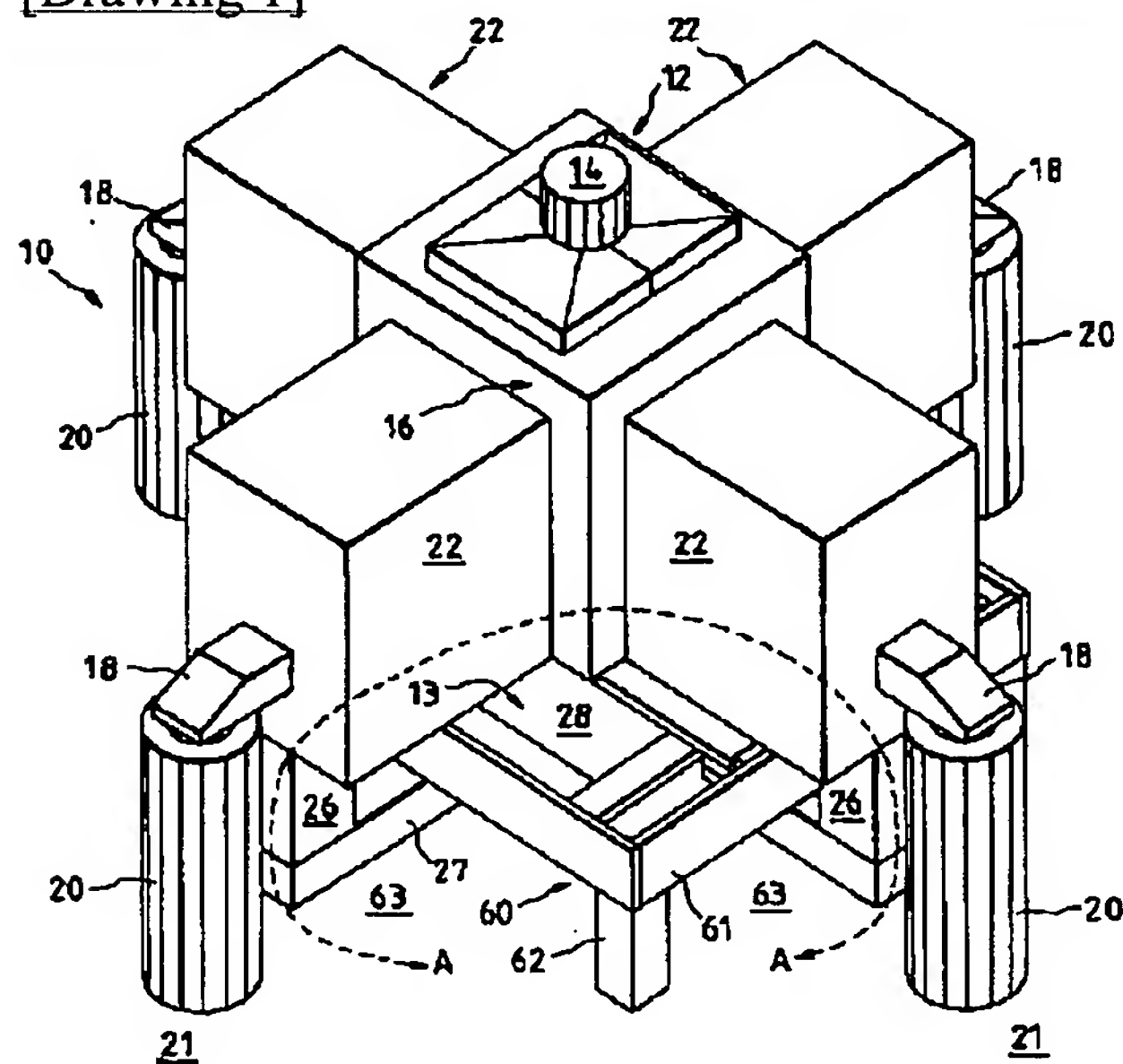
## \* NOTICES \*

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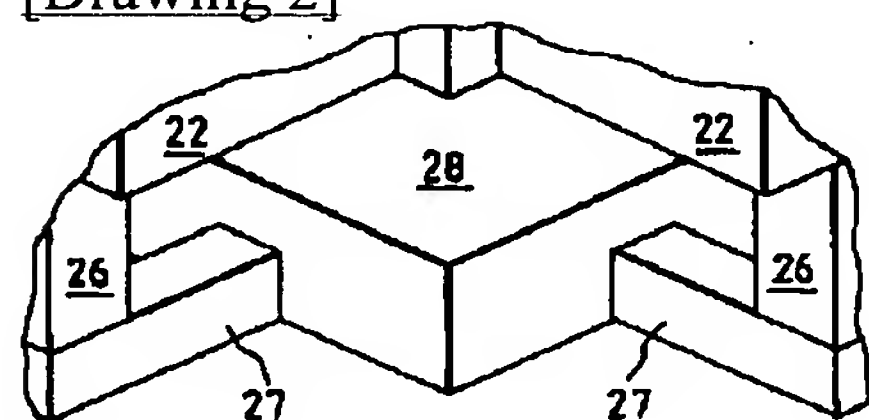
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3. In the drawings, any words are not translated.

## DRAWINGS

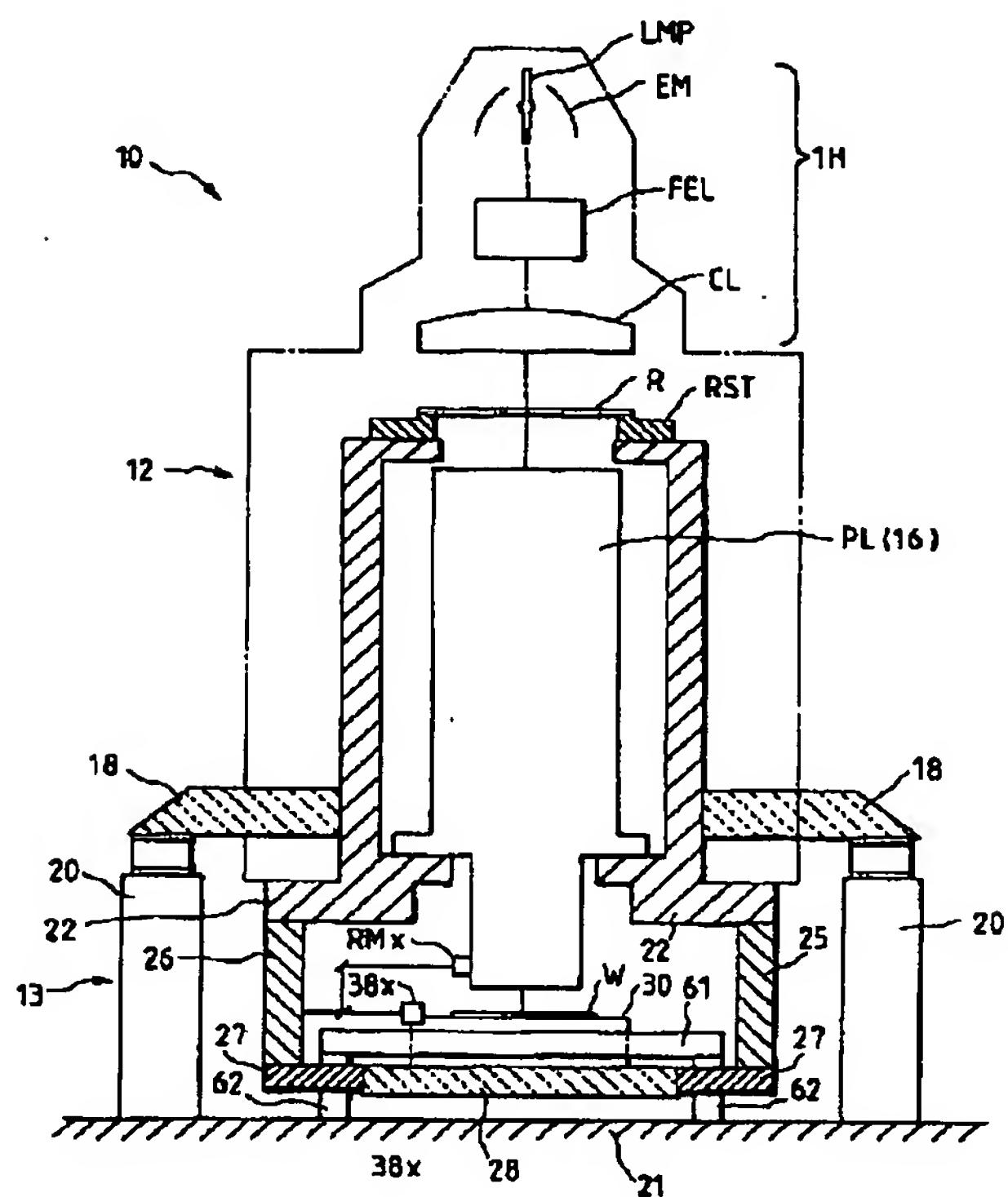
[Drawing 1]



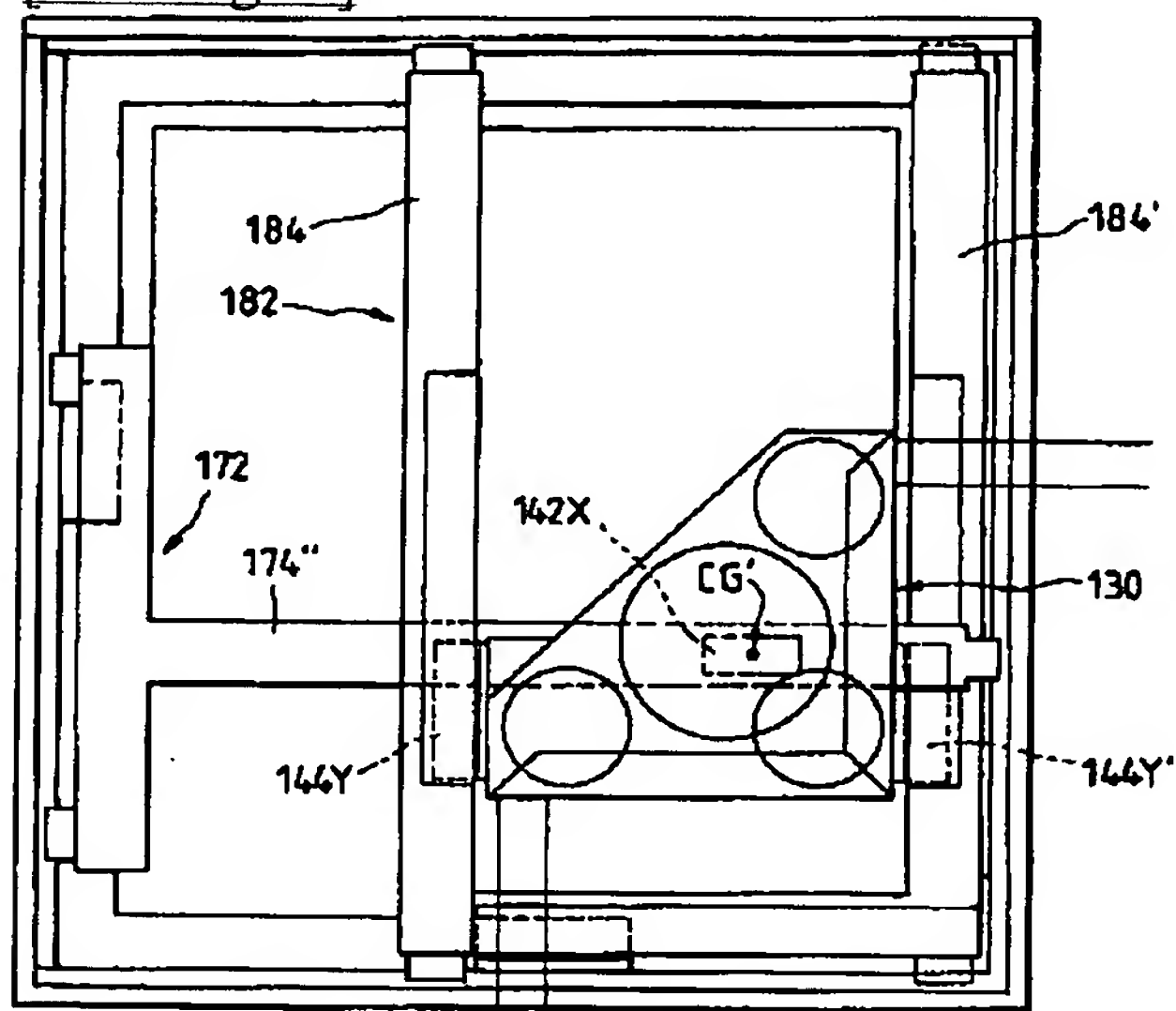
[Drawing 2]



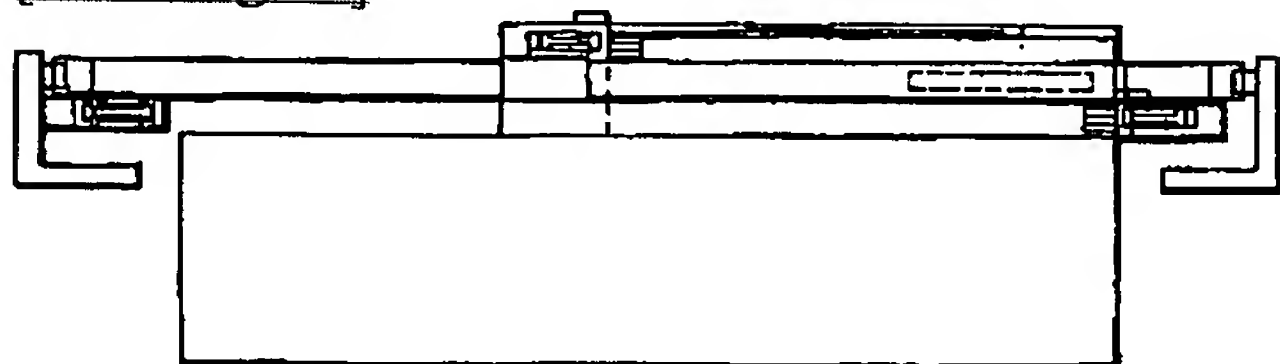
[Drawing 3]



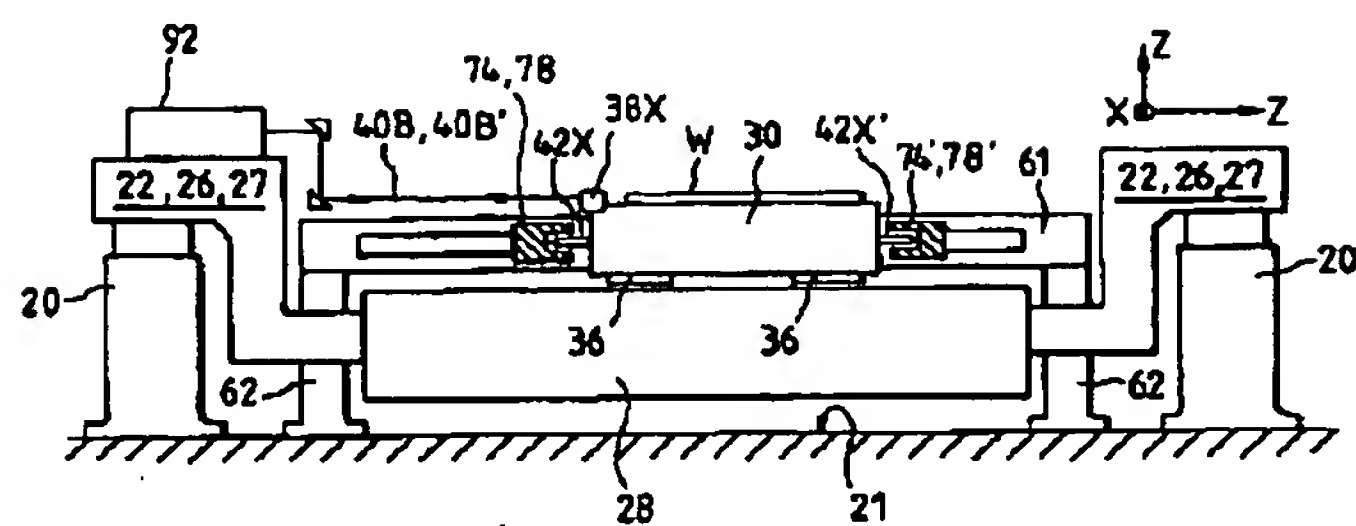
[Drawing 11]



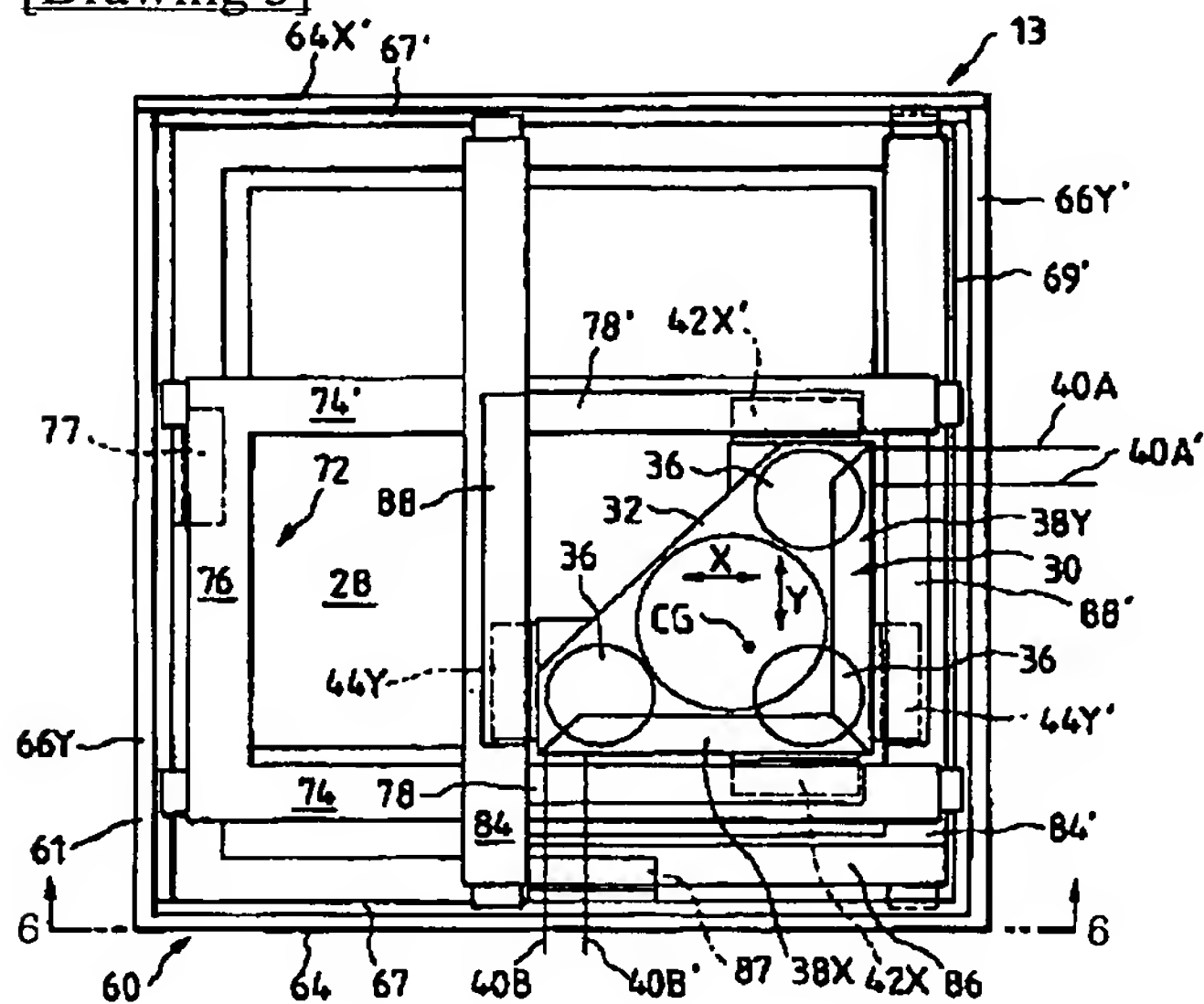
[Drawing 14]



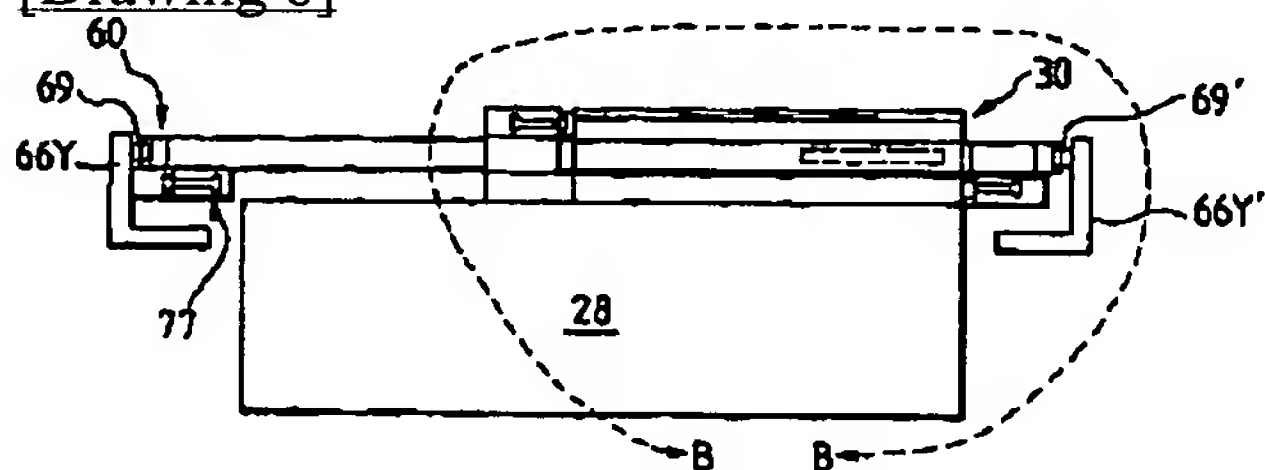
[Drawing 4]



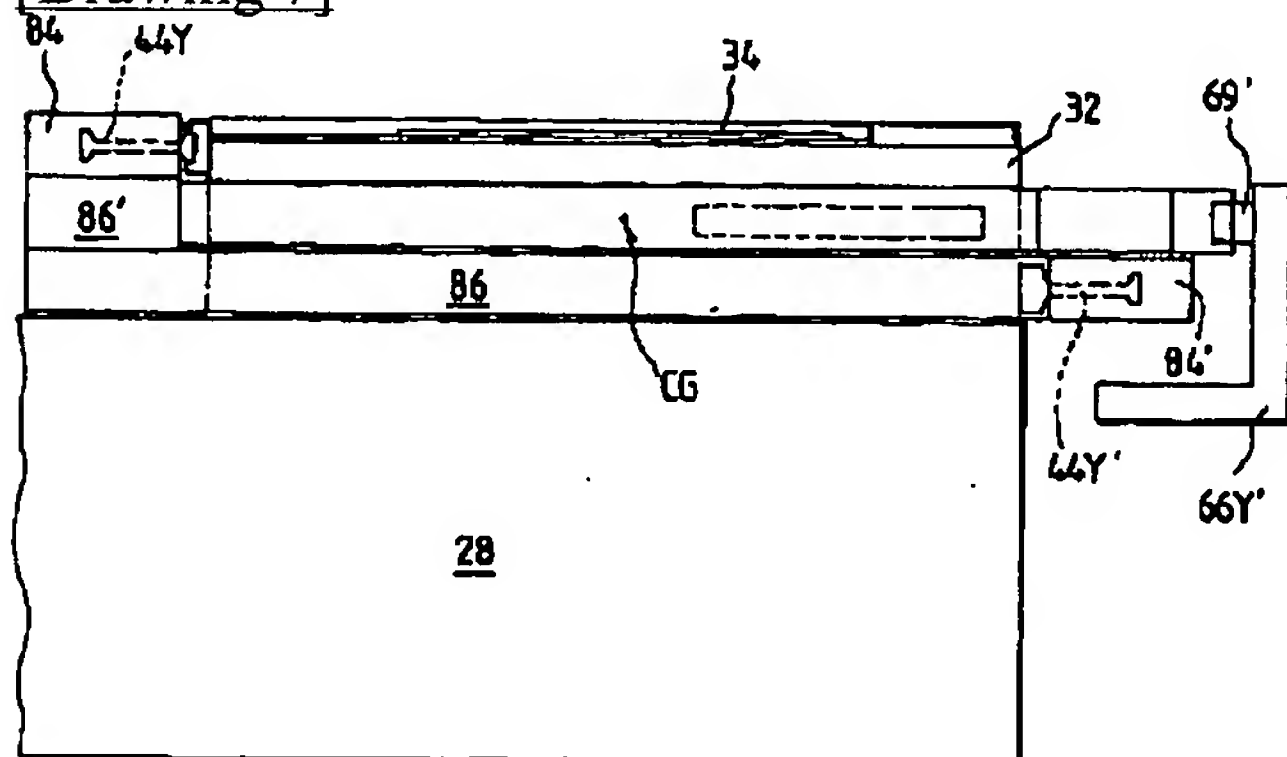
[Drawing 5]



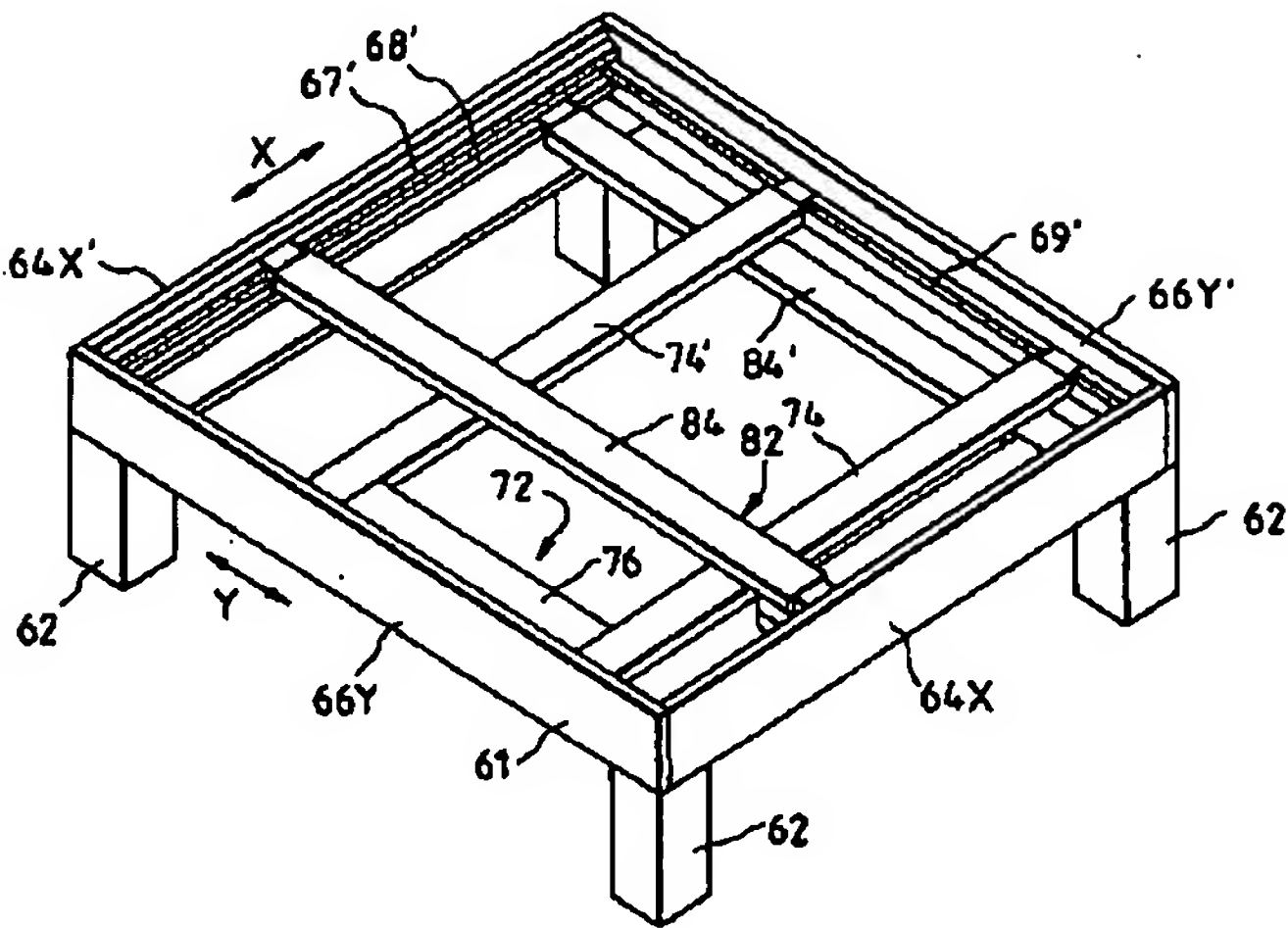
[Drawing 6]



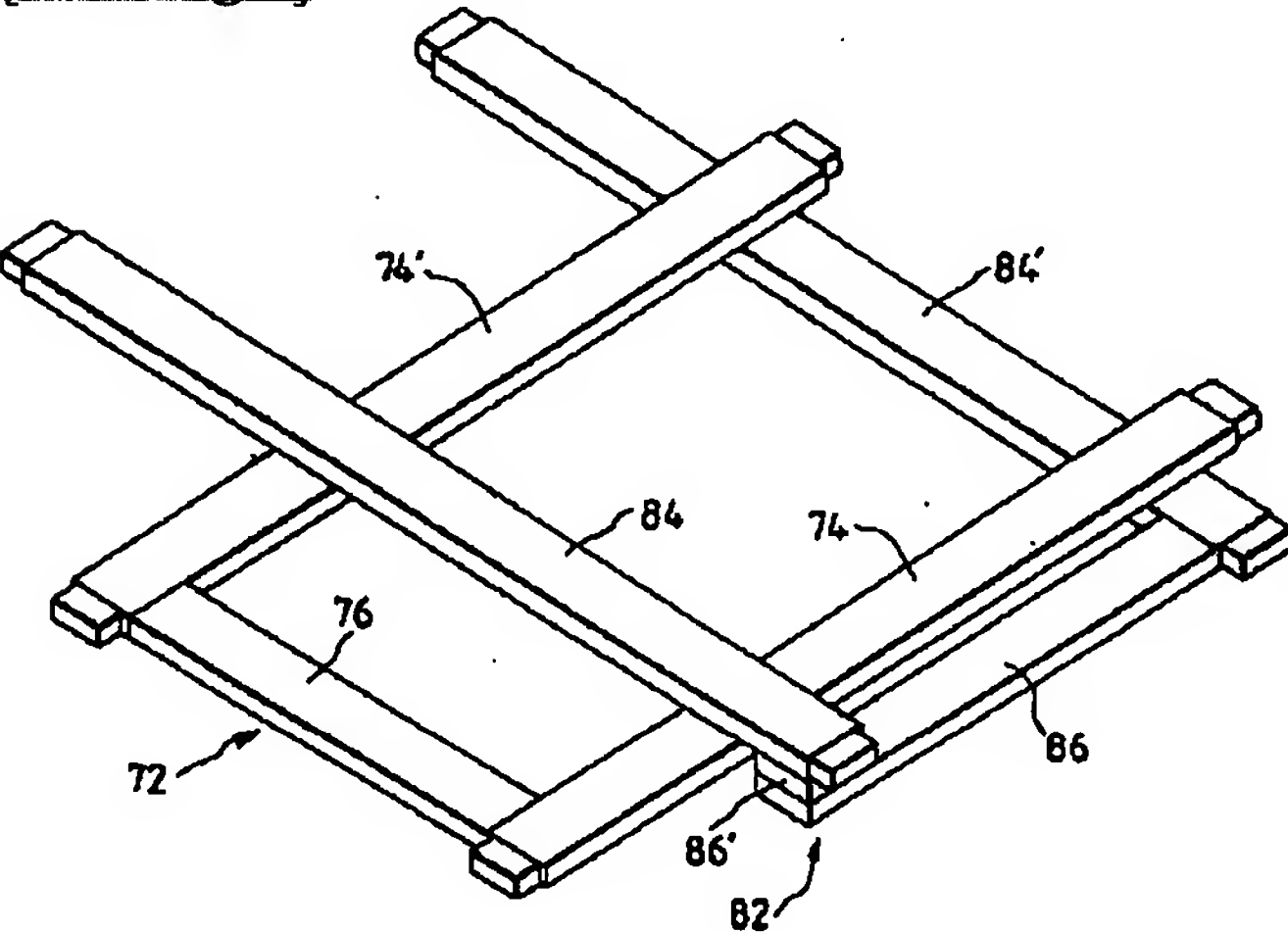
[Drawing 7]



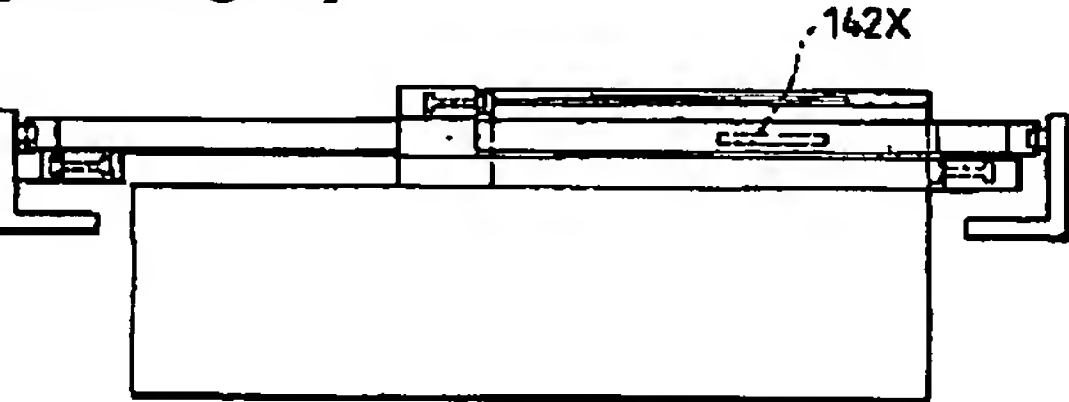
[Drawing 8]



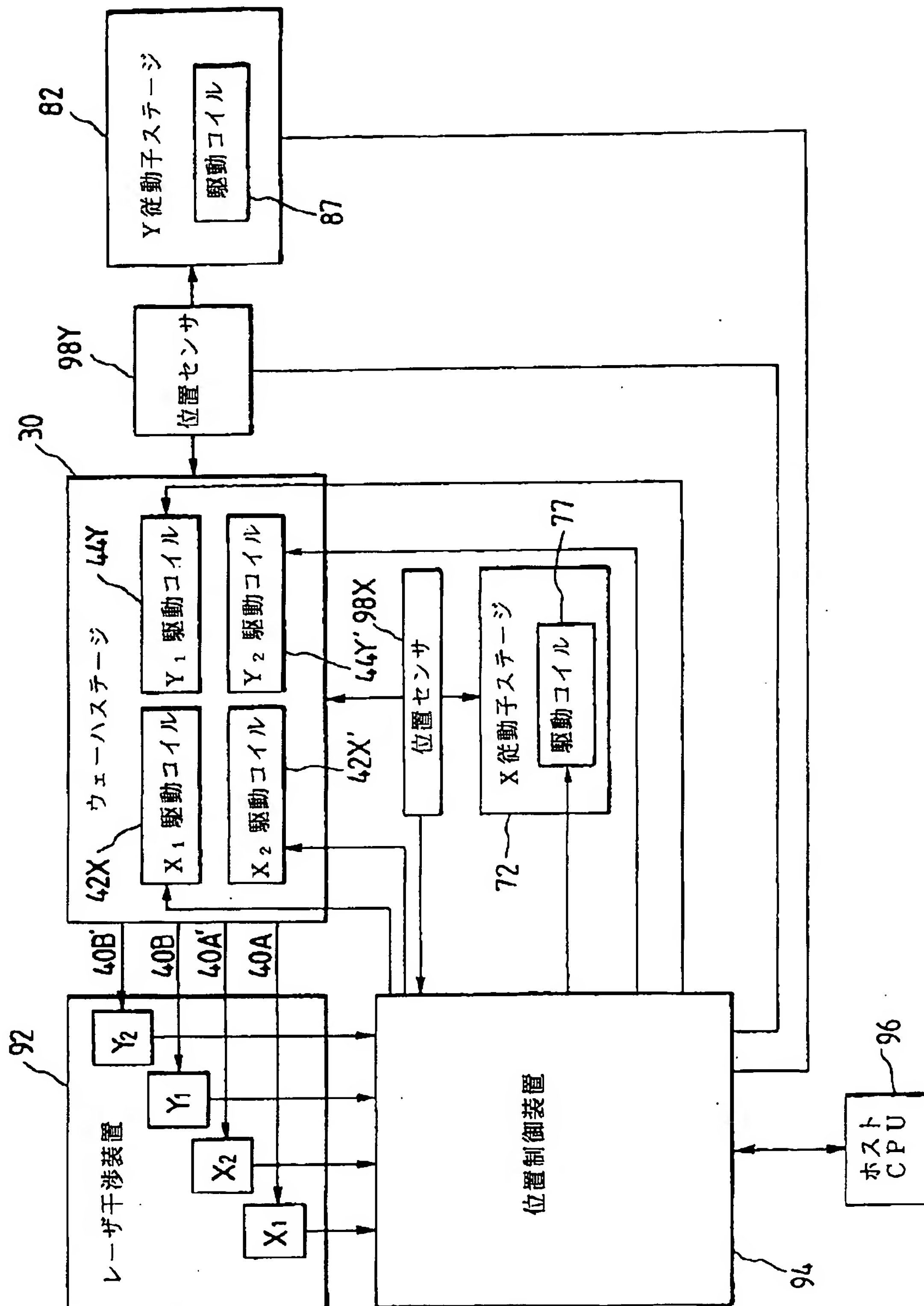
[Drawing 9]



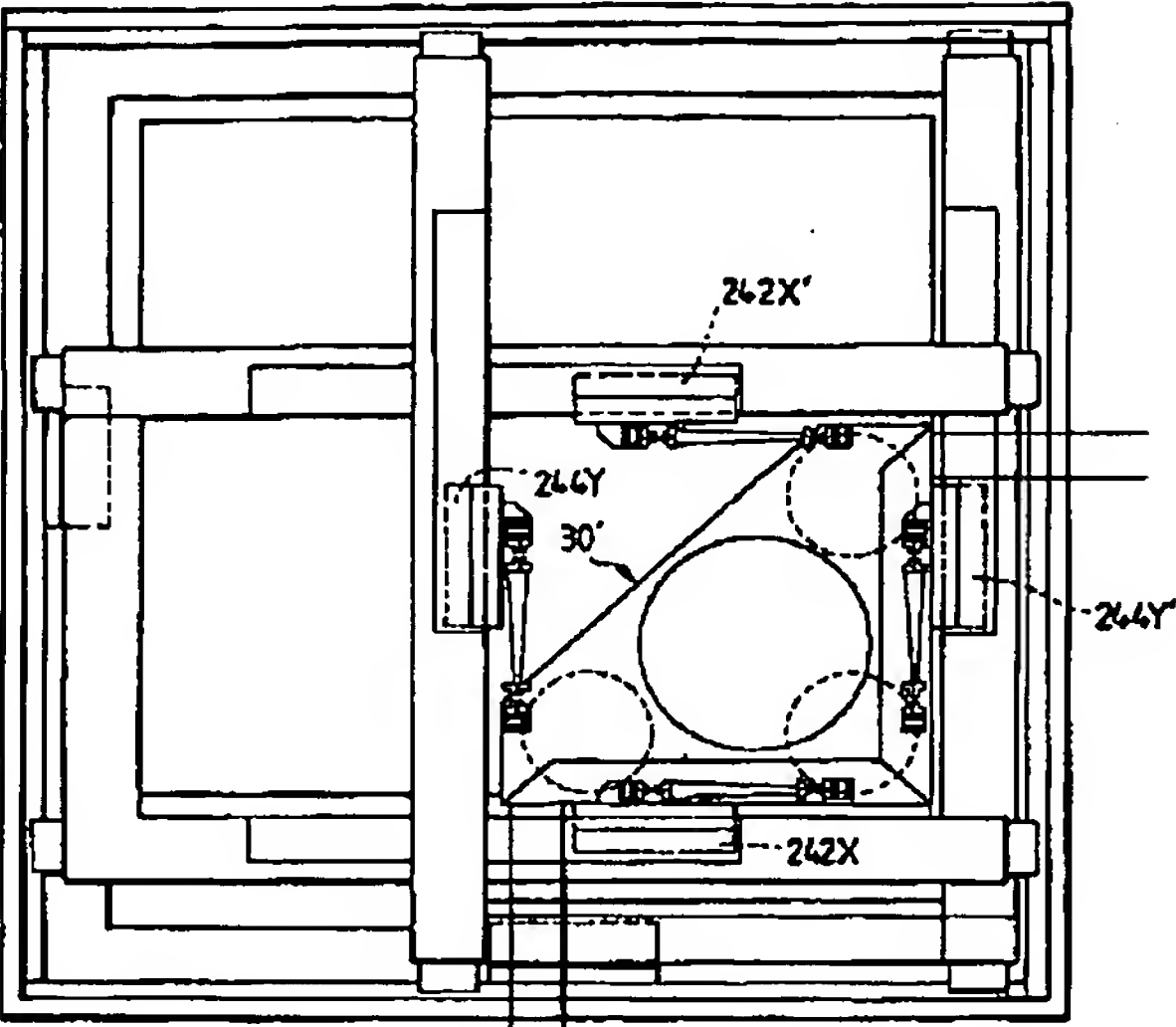
[Drawing 12]



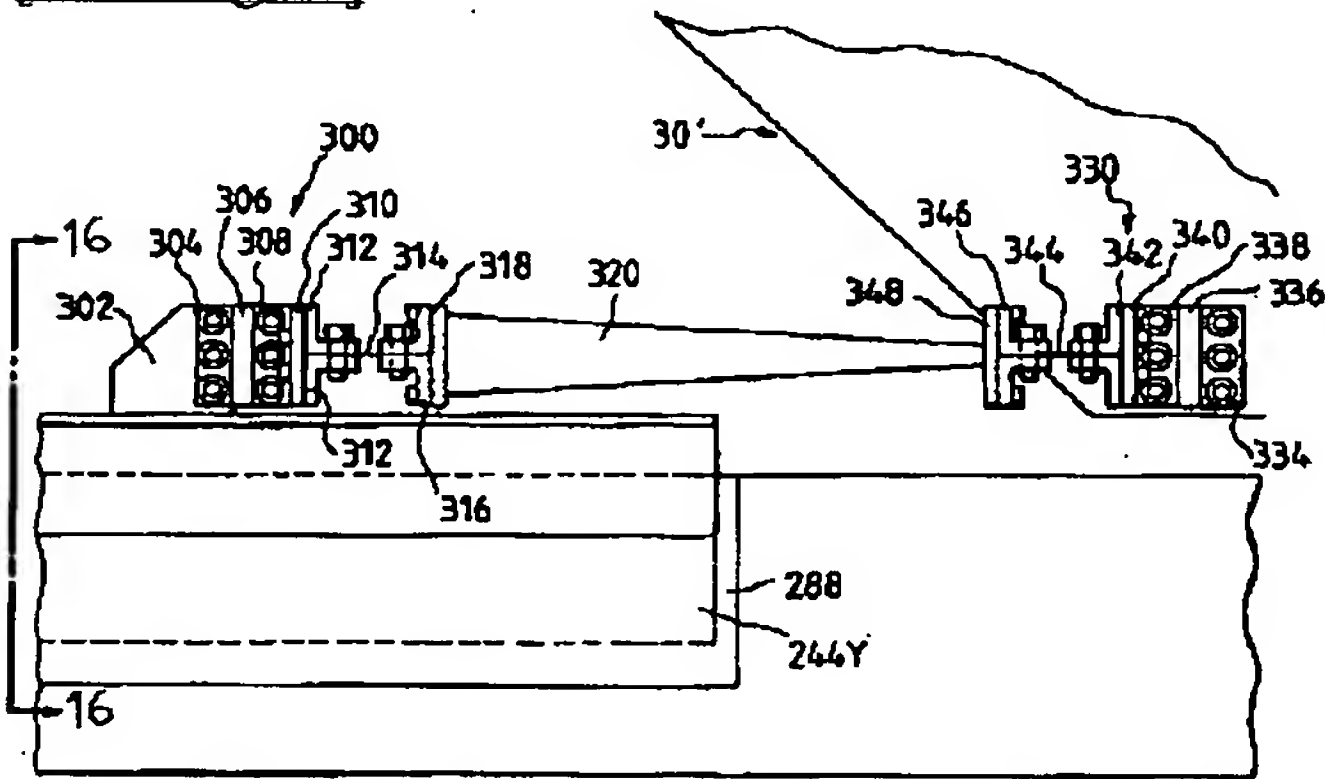
[Drawing 10]



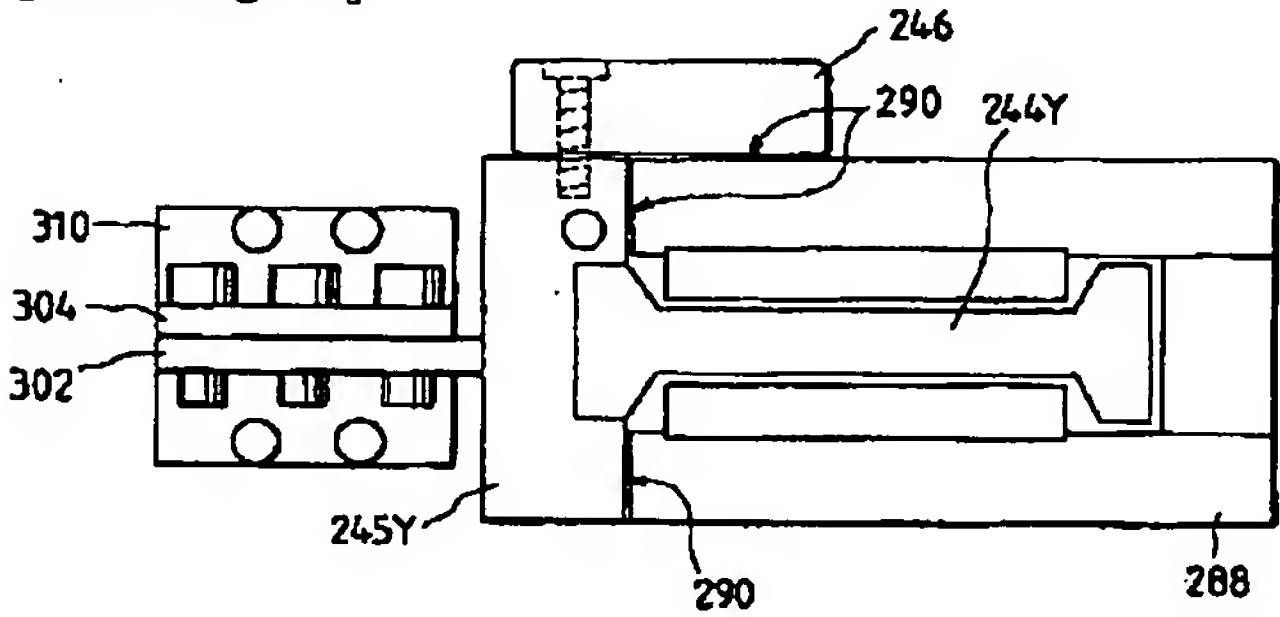
[Drawing 13]



[Drawing 15]



[Drawing 16]



[Translation done.]

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CORRECTION OR AMENDMENT

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[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

[Section partition] The 1st partition of the 6th section

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G12B 5/00

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[FI]

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[Procedure revision]

[Filing Date] August 13, Heisei 14 (2002. 8.13)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] In the pointing device which operates on base structure,

(a) The reaction frame assembly containing the reaction frame attached in said base structure,

(b) The object stage which exercises relatively to the base of an object stage,

(c) The means for setting spacing from the base of said object stage, and supporting said object stage independently with said reaction frame,

(d) It is attached in said object stage and said reaction frame assembly, and it becomes a pair for positioning said object stage, collaborates, and has the actuator means of the direct-acting mold which generates the force,

The pointing device which the base of said object stage and said object stage are insulated from the reaction force from said actuator means, and is characterized by transfer of the vibration to the base of said object stage and said object stage serving as min by this.

[Claim 2] The positioning device with which said reaction frame assembly is characterized by having the follower who can exercise for said object stage independently and can follow it in the positioning

device of claim 1.

[Claim 3] The positioning device characterized by equipping said actuator means with at least one linear motor which operates between said object stage and said reaction frame assembly in the positioning device of claim 1.

[Claim 4] the positioning device with which it has the actuator means of a lot at least in the positioning device of claim 1 in order to position said object stage, and the actuator means of these each is characterized by having the driving member attached in said object stage.

[Claim 5] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of said driving member is characterized by being substantially equal to zero in the positioning device of claim 4.

[Claim 6] The positioning device characterized by having at least one driving member attached in said object stage in the positioning device of claim 2.

[Claim 7] The pointing device characterized by for said follower having two arms which can exercise, respectively in two parallel flat surfaces, and the center of gravity of said object stage being between said two flat surfaces in the pointing device of claim 2.

[Claim 8] In the positioning device of claim 1 said object stage In the 1st direction, and this 1st direction and the 2nd direction which makes an include angle, it can exercise at least. The 1st follower is movable only in said 1st direction, and follows said object stage. The 2nd follower is movable only in said 2nd direction, and follows said object stage. Moreover, said actuator means to collaborate The pointing device characterized by being prepared for said object stage and said 1st and 2nd followers, and positioning said object stage in said 1st and 2nd directions.

[Claim 9] It is the positioning device characterized by having the direct-acting mold actuator which generates at least three force in which said actuator means operates between said object stage and said reaction frame assembly in the positioning device of claim 8.

[Claim 10] The positioning device with which it is prepared and the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to zero in the positioning device of claim 9 as said object stage driven in said 1st direction in two of said at least three direct-acting mold actuators.

[Claim 11] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage where one of said the direct-acting mold actuators other than said two direct-acting mold actuators is attached in said object stage, and it originates in the positioning force of said actuator means to collaborate, in the positioning device of claim 10 so that said object stage may be driven in said 2nd direction is characterized by being substantially equal to zero.

[Claim 12] In the positioning device of claim 8, it has at least 2 sets of direct-acting mold actuators for positioning said object stage. 1 set in these direct-acting mold actuator 1 set which will position said object stage in said 1st direction, and will accept it among said direct-acting mold actuators The pointing device with which the vector sum of the moment of force in the center of gravity of an X-Y stage which positions said object stage in said 2nd direction, and originates in the positioning force of an actuator means to these-collaborate is characterized by being substantially equal to zero.

[Claim 13] It is the pointing device which said 1st and 2nd followers have two arms \*\*\*\*(ed) respectively in the pointing device of claim 8, one follower's arm is located in a single flat surface, and can exercise, and is characterized by locating the arm of the follower of another side in two parallel flat surfaces in which said single flat surface is located between them, and being able to exercise.

[Claim 14] The positioning device with which the center of gravity of said object stage is characterized by being adjacently located in the inside of said single flat surface, or the flat surface of this single in the positioning device of claim 13.

[Claim 15] In a pointing device,

(a) The object stage which exercises at least in the 2nd direction which makes an include angle in the 1st direction and this 1st direction,

(b) With the 1st follower who is movable only in said 1st direction and follows said object stage

(c) With the 2nd follower who is movable only in said 2nd direction and follows said object stage

(d) The pointing device characterized by having a force actuator means of a direct-acting mold to collaborate for being attached in said object stage and a list at said 1st and 2nd followers, and positioning said object stage in said 1st and 2nd directions.

[Claim 16] It is the positioning device characterized by having at least three direct-acting type force actuators with which said actuator means operates among said object stage and said each follower in the positioning device of claim 15.

[Claim 17] The positioning device with which it is prepared and the vector sum of the moment of force in the center of gravity of said object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to zero in the positioning device of claim 16 as said object stage driven in said 1st direction in two of said at least three direct-acting mold actuators.

[Claim 18] The positioning device with which the vector sum of the moment of force in the center of gravity of said object stage where one of said the direct-acting mold actuators other than said two direct-acting mold actuators is attached in said object stage, and it originates in the positioning force of said actuator means to collaborate, in the positioning device of claim 17 so that said object stage may be driven in said 2nd direction is characterized by being substantially equal to zero.

[Claim 19] In the positioning device of claim 15, it has at least 2 sets of direct-acting mold actuators for positioning said object stage. 1 set in these direct-acting mold actuator Said object stage is positioned in said 1st direction. Another side of said direct-acting mold actuators The pointing device with which the vector sum of the moment of force in the center of gravity of an object stage which positions said object stage in said 2nd direction, and originates in the location force of an actuator means to these-collaborate is characterized by being substantially equal to zero.

[Claim 20] It is the pointing device which said 1st and 2nd followers have two arms \*\*\*\*(ed) respectively in the pointing device of claim 15, one follower's arm is located in a single flat surface, and can exercise, and is characterized by locating the arm of the follower of another side in two parallel flat surfaces in which said single flat surface is located between them, and being able to exercise.

[Claim 21] It is the pointing device with which the vector sum of the moment of force in the center of gravity of said object stage which originates in the positioning force of a driving member of said follower having at least one driving member in each, and collaborating, in the pointing device of claim 20 is characterized by being substantially equal to zero.

[Claim 22] The positioning device with which the center of gravity of said object stage is characterized by being adjacently located in the inside of said single flat surface, or the flat surface of this single in the positioning device of claim 20.

[Claim 23] The pointing device of claim 15 characterized by being constituted so that it may have the following, and it may insulate from vibration which the base of said object stage and said object stage produce according to each reaction force by this, therefore vibration of the base of said object stage and said object stage may become min. The base of an object stage The reaction frame assembly which has the reaction frame prepared in base structure The means for supporting said each follower from said reaction frame assembly The means for setting spacing from the base of said object stage, and supporting said object stage independently with said reaction frame

[Claim 24] In alignment equipment,

(a) The X-Y stage which has a center of gravity,

(b) The means for setting said X-Y stage from the base of an X-Y stage, and supporting spacing,

(c) It has the reaction frame assembly which has the reaction frame which became independent of the base of said X-Y stage, and which was supported on the base of a reaction frame,

(d) said reaction frame assembly -- becoming independent -- X follower who can exercise, and said X follower who has independently Y follower who can exercise and was attached in said reaction frame possible [ movement ] -- the direction of X -- movement -- possible -- moreover, said reaction frame -- movement -- possible -- an installation \*\*\*\*\* Y follower -- the direction of Y -- movement -- possible

(e) Either said X follower or Y follower has at least two \*\*\*\*(ed) arms, and another side of said X follower and Y follower has at least one arm,

The alignment equipment concerned is ,

(f) It is prepared by the relation \*\*\*\*(ed) among said X-Y stage and said each follower, and has a direct-acting mold actuator means for the pair for positioning said X-Y stage horizontally to collaborate, and to generate the force,

(g) Said actuator means is equipped with the drive partial element means formed in the arm of said follower of each, and a drive primary-member means for it to be prepared in said X-Y stage to it, to collaborate with said drive partial element means, and to position said X-Y stage,

The base of said X-Y stage and said X-Y stage are alignment equipment which is insulated from vibration produced according to reaction force, and is characterized by being constituted so that the base of said X-Y stage and vibration of said X-Y stage may become min by this.

[Claim 25] In the alignment equipment of claim 24, said one arm prepared for either said X follower or the Y followers Two arms which are arms of said pair which could exercise in the single flat surface and was prepared in another side of said X follower and Y follower Alignment equipment characterized by locating in two independent flat surfaces in which said single flat surface is located between them, respectively, and being able to exercise in this flat surface.

[Claim 26] Alignment equipment with which the vector sum of the moment of force in the center of gravity of said X-Y stage which has said drive partial element means formed in the arm of said pair of said one follower in the alignment equipment of claim 25, is equipped with the means for controlling it, and originates in the positioning force of a drive primary-member means to collaborate is characterized by being substantially equal to zero.

[Claim 27] In the approach for positioning an object,

(a) The process which positions a reaction frame on the base,

(b) The process which supports an object on an object stage,

(c) The process which supports said object stage independently for said object on space in a certain location from the base of an object stage with said reaction frame,

(d) The positioning approach characterized by applying the force between said object stages and said reaction frames, driving said object stage in the new location of at least one direction of [ on space ], and having the process which insulates the base of said object stage from the reaction force produced by applying said force to coincidence.

[Claim 28] In the approach of positioning an object stage to space by moving in the 1st direction and 2nd direction by the 1st follower and 2nd follower at least,

(a) The process which supports said object stage to space,

(b) between said object stage and said 1st follower -- the force -- in addition, the process which drives said object stage only in said 1st direction,

(c) between said object stage and said 2nd follower -- the force -- in addition, the process which drives said object stage only in said 2nd direction,

(d) The process which drives said 1st follower and is made to follow said object stage independently with said 2nd follower only in said 2nd direction,

(e) The positioning approach of the object characterized by driving said 2nd follower and having independently the process made to follow said object stage with said first follower only in said 1st direction.

[Claim 29] The positioning device with which it has a means to attach said actuator means between said object stages and said reaction frames, in the positioning device of claim 1, and this installation is characterized by the strong thing in the direction of driving force at least.

[Claim 30] The positioning device with which it has a means to attach said actuator means among said object stage and said each follower, in the positioning device of claim 15, and this installation is characterized by the strong thing in said direction of driving force at least.

[Claim 31] The positioning device with which it has in the positioning device of claim 24 with a means to attach said actuator means among said X-Y stage and said each follower, and this installation is characterized by the strong thing in said direction of driving force at least.

[Claim 32] the base plate which has a flat surface -- this -- the precision pointing device which has the stage which can exercise along a predetermined direction in a flat surface top -- setting

- (a) The 1st support assembly for supporting said base plate on a foundation,
  - (b) It has an actuator assembly for giving electromagnetic force to the stage in which said movement is possible along said predetermined direction, and this actuator assembly,
  - (i) the passive-movement section which is attached in the stage in which said movement is possible, and can exercise in said predetermined direction and which can be exercised -- and
  - (ii) The mechanical component located in the perimeter of the stage in which said movement is possible is provided,
  - (iii) Either said passive-movement section or said mechanical component has a coil unit, and another side of said passive-movement section and said mechanical component has the magnetic unit,
- Further,
- (c) The precision pointing device characterized by having the 2nd support assembly which supports said mechanical component independently on said foundation with said 1st support assembly, and forms a predetermined gap between said coil units and said magnetic units by this.
- [Claim 33] The precision positioning device characterized by holding said mechanical component of said actuator assembly to said predetermined direction in the precision positioning device of claim 32 in the stationary location.
- [Claim 34] In the pointing device of claim 1,  
The pointing device characterized by having an interferometer means to detect the location of said object stage.
- [Claim 35] In the pointing device of claim 1,  
The pointing device characterized by having the support means which supports the base of said object stage independently with said reaction frame.
- [Claim 36] In the pointing device of claim 35,  
The pointing device characterized by having an interferometer means to detect the location of said object stage.
- [Claim 37] In the pointing device of claim 36,  
Said interferometer means is a pointing device characterized by having the mirror prepared in said object stage, and interferometer equipment formed in said support means which supports the base of said object stage.
- [Claim 38] In the pointing device of claim 2,  
The pointing device characterized by having the position sensor which detects spacing of said object stage and said follower.

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[Translation done.]